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XXII. *Note on a Paper by Dr. JOHN DAVY, entitled "Notice on the remains of the recent Volcano in the Mediterranean." By CHARLES DAUBENY, M.D. F.R.S., Professor of Chemistry in the University of Oxford.*

Received May 13,—Read May 16, 1833.

AT the request of the Council of the Royal Society, I propose to submit the following remarks on a paper of Dr. JOHN DAVY's that has recently been read on the subject of the new volcanic island lately thrown up in the Mediterranean ; being desirous of directing the attention of men of science in a more particular manner to the examination of the gases evolved by volcanos, and likewise of pointing out to them certain objections which appear to militate against the hypothesis, by which, in the communication alluded to, the disengagement of nitrogen, accompanied with only half the proportion of oxygen present with it in atmospheric air, is accounted for.

Nitrogen gas has not hitherto, I believe, been often observed to issue from volcanos in action ; but the frequent presence of ammoniacal salts amongst the vapours given off by them affords a fair presumption that, if looked for, the gas itself might be found to occur more commonly ; especially as the great majority of hot springs—whether such as are immediately and confessedly connected with volcanos, as that of Castella, near Naples, or that more numerous class which are supposed by many geologists (though without such direct evidence,) to owe their temperature to causes of an analogous nature,—copiously evolve it, often in a state of purity, but sometimes, as in the specimen examined by Dr. DAVY, intermixed with a certain proportion of oxygen \*.

Under such circumstances, the more obvious conclusion would seem to be,

\* Having given the details of this subject already, in a paper "On Thermal Waters and their Connexion with Volcanos," published in the Edinburgh New Philosophical Journal, conducted by Professor JAMESON, for 1831, I will here only state that the evolution of nitrogen, which was discovered long ago by Dr. PRIESTLEY at Bath, and by Dr. PEARSON at Buxton, has been lately found by myself

that the evolution of this gas is in some way or other connected with certain chemical processes going on at, or near the place of its occurrence. And in this point of view any account relating to the phenomenon in question derives an interest beyond what it would obtain according to Dr. DAVY's mode of considering it, as being calculated in a more especial manner to afford us a clue to the hidden causes of volcanic action in general.

It may therefore not appear irrelevant, if I proceed to point out certain objections that have occurred to me with reference to the latter portion of Dr. DAVY's paper; in which nothing more than the mere evolution of the gas is attributed to the volcano itself; whilst the absence of a portion of that oxygen which accompanies it in common air, is resolved into putrefactive processes, going on generally at the bottom of the sea, and therefore wholly unconnected with the particular nature of the locality.

I would observe in the first place, that the notion of sea-water at great depths being wholly or partially deprived of its oxygen by animal putrefaction, &c., seems inconsistent with the general analogy of nature, since in all other cases there appear to be counteracting causes which restore to the air its purity; and that notwithstanding the rapid diminution of light in descending through so dense a medium as water, still the existence, at great depths, of Algæ possessing an intensely green colour would seem to indicate, that the decomposition of carbonic acid is going on there as well as upon land. Indeed, owing to the constant circulation taking place in every mass of water, especially if supposed to rest upon a heated substratum, any influence that might be exerted upon the nature of the air contained would be quickly spread over the whole body of the sea, instead of being limited to its inferior portions, where, moreover, the very existence of animals, which must imbibe this air, leads us to conclude, that no material difference in its quality could obtain.

Granting even the nature of the air contained in sea-water at the bottom of the Mediterranean to be such as Dr. DAVY represents, I do not understand

to take place also at Bakewell and Stony Middleton, in Derbyshire, and at Taafé's Well, near Cardiff in South Wales;—that I have likewise detected it issuing from the hot springs of Mont Dor, and Chaudesaigues in central France, and those of St. Gervais, Cormayeur, St. Didier, and Bonneval in Savoy;—and that Longchamp states its occurrence at Vichy and in all the thermal waters at the foot of the Pyrenees. Other instances are mentioned in the paper referred to.

how it can find its way to the surface, in consequence merely of the high temperature to which it is subjected below. Either, in this situation, the pressure of the superincumbent mass of fluid is sufficient to prevent the conversion of the lower strata of water into steam, or it is not. If it be, this same pressure will enable the water to retain in solution its original quantity of air, or at least the greater proportion of it. If, on the contrary, there be not sufficient pressure for the purpose, then no doubt the water will rise up in the form of steam through the superincumbent mass along with the air which it had contained; but as the temperature of the sea round about the volcano, at least near its surface, is stated by Dr. DAVY not to be higher than that of the atmosphere, it is plain that all the steam must become rapidly condensed, and when it returns to its liquid state, there seems no reason why it should not exert its affinity for the air intermixed, and combine with it as before.

For these reasons, amongst others, I conceive that the air which Dr. DAVY examined cannot have been derived from sea-water, but must have originated from the atmosphere itself, with which this volcano, from its contiguity to Malta and Sicily, may with less difficulty be supposed to communicate; and this is favoured by the probable upheaving of the bed of the Mediterranean underneath the spot at which the island made its appearance; for the proofs of which I may appeal to the memoir of Captain SMYTH, lately published in the Transactions, as an Appendix to Dr. DAVY's former paper on this subject.

Now the upheaving of the bed of the sea would imply the existence of hollows or caverns underneath, into some of which, if not in immediate connexion with the water above, atmospheric air would doubtless find admission.

I would also observe, that if the quantity of gas emitted bore any proportion, as Captain SWINBURNE states it did, to that observed in chalybeate springs, so constant a supply could hardly have been derived from such a source as sea-water; for 100 cubic inches of pure distilled water (which holds in solution rather more air than sea-water will do,) only contain about one cubic inch and a half of nitrogen; and in most thermal waters that have been examined, the evolution of this gas is much more copious than it is here represented, and makes its appearance in large and frequent bubbles, and not "in minute silver threads."

In a word, I conceive that Dr. DAVY has under-rated the interest which

ought to attach to the information he has afforded respecting the gases given off on the site of this new volcano, by explaining their composition on principles unconnected with volcanic action ; whereas a higher importance really attaches to them, if considered, as it appears they ought to be, intimately related to the latter train of effects.

As, however, our estimate of his theory (at least as extended to the case of thermal waters,) may in part depend upon the quantity of gas evolved in a given time, it is to be regretted that no accurate statements of this have as yet, so far as I am aware, been published ; and I therefore would invite such men of science as may chance to be conveniently situated for such researches, to examine the volume of gas emitted by some of our own warm springs, as by those at Bath or Buxton ; which inquiry, indeed, I hope at some future time to undertake myself, should not the necessity for it be superseded by the previous investigations of others.